THE CORNELL ENGINEER

February, 1944
Volume 9—Number 5

The CORNELL ENGINEER

Founded 1885

Volume 9 — FEBRUARY, 1944 — Number 5

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Published monthly--October to May—by the **Cornell Engineer, Inc.,** Lincoln Hall,, Ithaca, N. Y. Edited by the undergraduates of the College of Engineering, Cornell University. Entered as second class matter at the Post Office at Ithaca, N. Y., under Section 103, Act of October 3, 1917.

The **Sibley Journal of Engineering** was founded in 1885, the **Cornell Civil Engineer** in 1891. The two were consolidated in 1935 into the **Cornell Engineer.**

Subscription per year: regular $1.50; with membership in the Cornell Society of Engineers $2.00 (See President's page); student $1.00; single copy $.20.

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Guarding One Billion Men

E. C. M. Stahl

EDWARD C. M. STAHL, M.E. (E.E.) '13

DURING the past twelve months, upwards of 200 billion kilowatt hours of electric energy were produced in the United States. This represents the equivalent physical labor of one billion able-bodied men for a whole work year. Naturally, the protection of this enormous source of energy and its distribution has always been the concern of the utilities. With the advent of the war many government agencies have exhibited marked interest in protecting the power plants and transmission systems, as at present the bulk of this energy goes directly or indirectly into the war effort. The utility companies, together with civil and military groups, have surveyed the requirements of each installation and set up procedures for insuring adequate protection.

Previous to this, along with the growth of the utilities, many types of safeguards and procedures were developed to insure safety to life, continuity of service and safety of equipment, so that in most cases very little was required to be added to existing safeguards. The few recommendations submitted by the investigating groups consisted mostly of standardizing protective measures, formalizing entrance procedures and adding some physical safeguards covering the approach and entrance to properties, and some additional provisions for air raid protection.

Due to the nature of electric utilities, having large waterfront properties, and extensive distributing facilities throughout cities and inland territory, their operations overlapped all of the jurisdictional areas of a large variety of government agencies charged with protecting vital industry in war as well as those bodies empowered by law to regulate the industry. Therefore, utilities have had to satisfy the F.B.I., Navy, Coast Guard, Army, State Guard, Federal Power Commission, Public Service Commission, local Police and Fire Departments, Air Raid Services and other agencies as to the procedural and physical safeguards in effect.

THE AUTHOR

Edward C. M. Stahl entered Cornell University in 1909; and before he graduated became a member of Phi Kappa Tau and Scabbard and Blade as well as Editor of the Sibley Journal of Engineering. While at college he possessed a New York State Scholarship.

After graduation he worked for the New York Central Railroad until the First World War, when he became a captain in the Coast Artillery. In 1922 he entered the employ of the Brooklyn Edison Company and became assistant manager of the Electric Production Department of the Consolidated Edison System in 1937. At present he is manager of the Substation Operation Department of the Consolidated Edison Company of New York.

Mr. Stahl is past president of the Cornell Society of Engineering and is a member of both the A.I.E.E. and the A.S.M.E.

Fundamental Protection

The fundamental protection of electric utilities has been built into the design and construction of generating stations, substations and transmission systems over the years. Segregation and physical isolation by distance or by fire and explosion-proof walls has so diversified the availability of generation and distribution that it is very unlikely that, even locally, there could be a disastrous disruption of electrical supply, other than by large scale military attack.

All problems of security have been carefully considered from the angle of a mere nuisance interruption of short interval up to a major, long time failure of vital apparatus. The required protection has then been proportioned accordingly.

Damage to utility installations can result: (1) from enemy action by their armed forces; (2) from natural causes such as floods, tidal waves, hurricanes, ice storms, etc.; (3) from the usual types of equipment breakdown; and (4) by sabotage. Protection from enemy action is primarily the general responsibility of our armed forces; the proba-

bility of major damage from natural causes has been eliminated as far as consistent with the economic factors involved; usual types of breakdown are provided for by spare equipment, so that sabotage is about the only item requiring additional precaution.

Employee Loyalty

The prime defense against sabotage is the loyalty of employees. The secondary defense is insuring that only accredited persons enter a plant and that only materials intended for the plant are brought in. As utilities have been very careful over many years to check applicants for employment and investigate their previous employment, the loyalty of personnel was already well established at the outbreak of the war. However, any person about whom there was the slightest doubt was reinvestigated with particular reference to his off-the-job friends, relatives and associates. As a consequence, an occasional individual was found to be of doubtful loyalty and suitable measures were employed to eliminate him as a source of possible embarrassment.

Material for delivery into a power plant being checked against bill-of-lading by storeroom employee. Driver's credentials, truck license and identification checked by station guard.

In many cases employees were assembled from time to time and given talks on the importance of their plant to the war effort and their own personal responsibility with respect to continuity of service. They were individually charged to watch out for any unusual behavior or activity by persons in the vicinity of their work and were cautioned to keep their eyes and ears open at all times for suspicious implications.

As a further deterrent both to employees and outside persons, federal and state laws have been promulgated and warning signs based on these various laws posted prominently around all utility properties. Heavy penalties are provided for violations of these laws.

About the only enemy action that might be expected in this country is an air raid, and, consequently, there has been a considerable amount of study and the formulation of practices and procedures to counteract the effects of such a raid. In all localities there has been very close cooperation with the air raid services, as well as the institution of a coordinated program satisfactory to civil and federal authorities. In this case too, the normally developed organizations and procedures for handling utility emergencies formed the basis for the setup necessary to protect and re-establish services should damage be caused by air raids. The general service of protection consists of an organization to which competent supervisors are assigned in rotation, so that there is a continuously available group of supervisors from all necessary operating and engineering departments on duty and available at any hour of the day and night, to take charge of the direction of any unusual occurrence. These persons are supplementary to the normal continuous services of the System Operators, Load Dispatchers, District Operators, Emergency Foremen, and the normal personnel on rotating shifts.

Air Raid Protection

In addition to the usual relationship between the utilities and local Police and Fire Departments, arrangements have been worked out for handling unusual situations which might arise at the time of air raid damage.

The protection of plants and equipment against air raid required the study of each individual building and location and deciding of what general and specific measures should be adopted to minimize the effects of a raid, and particularly to see what alternative methods of providing service are available or should be provided. In most utility systems the layout is such that a sizable portion of generation can be shifted from one station to another, and the diversity of transmission lines and mains is such that no major area would be without a source of electric supply even should a generating station be damaged. Consideration was also given to the diversified location of spare parts and equipment to eliminate possibilities of large loss at one place.

More specifically, the following illustrations are based on what a large metropolitan system is doing:

The general contingencies incident to restoration of service in emergency conditions have been established, and very comprehensive procedures have been developed and frequent drills held to insure thorough familiarity with the procedures. These methods contemplate restoration both with or without communications.

All localities have had emergency equipment for fire-fighting and have first aid as recommended by Fire Underwriters and medical advisors so that practically no additional equipment was needed; however, some rearrangment of equipment was desirable in many cases. In all stations gas masks are available for fighting fires and rescue work, and these have been supplied with a military type canister which can

be used in case of a local gas attack. Great care has been taken to see that copies of drawings, plans and records are readily available at all locations, and also that duplicates are available at some other designated location, so that there would be no delay in rebuilding or in ordering spare equipment due to lack of records.

The protection of personnel under air raid conditions has had very careful study and procedures have been worked out and periodic drills are held to insure complete familiarity with the procedures.

Means and methods for the communication of air raid warnings to employees have been set up at all locations. All important telephone communications are routed over two or more separate individual lines between stations, and within stations separate emergency communication systems are available.

One of the major problems, that of blackout, has been satisfactorily worked out for all operating plants; frequent drills are held under blackout conditions in order to insure complete familiarity with the operations.

Admission to Stations

Getting back to the more immediate problem of routine station protection, we come to the methods and safeguards of admitting persons and supplies to stations. Generally speaking, the procedure consists of advance information to the plant of the person, persons, or material to be expected and the approximate time they will appear. On appearance, credentials and identification carried by the individuals and copies of orders for the materials being delivered must agree with the advanced information, and furthermore the evidence must satisfy the watchman that the credentials belong to the person entering. Photographs, fingerprints and signatures together with the pass number, driver's license number, social security number, etc., are means of identification which are carefully scrutinized when presented. Persons admitted into any station must wear a prescribed badge of identification prominently displayed on their outer clothing. An employee regularly assigned to a station or plant wears a button having his photograph and employee number on it. A person having temporary work in a plant is given a regular identification button with a number on it at the time he enters the station. Contractors and manufacturers' employees must wear a button furnished by their employer which must have on it the firm's name and the number assigned to their employee. As a further check each department of the utility company uses a different color for the buttons assigned to its members, so that individuals may readily be distinguished as to the character of the work and the location in which they should normally be found. Again, the contractors must have a distinguishing assortment of buttons to identify the specific areas in which certain of their employes may be allowed to work.

At the entrance all packages, suitcases, briefcases or other bundles must be inspected by the watchman before they are allowed to be taken in or out of the station. In order to expedite the entrance and exit of the regularly employed persons at a plant, a plant register is set up for each location consisting of the company employees assigned to that location, and on entering or leaving the person must exhibit his identification card containing his picture as well as his identification button to the watchman, who will scrutinize them carefully along with the person passing him. There is a permanent register carrying the names of employees who are not assigned to a single station but make frequent trips to stations. This permanent register consists of a book made up of 5" x 7" pages, one for each individual. The page contains a 2½" x 3" photograph of the head of the person, his name, title, department and employee number and his personal signature. This serves as advance notification. His identification card must agree with the permanent register, written at the time of entry, which must be compared with that in the book and on the identification card.

A station superintendent being checked and identified by guard, before admission to his own station.

Coast Guard Pass

All station employees at generating stations are required to have a Coast Guard Pass with them at all times, and all persons entering a generating station should have a Coast Guard Pass or other acceptable evidence of fingerprinting in addition to any other means of identification required before being permitted to enter a station.

As a further precaution stations are zoned, particularly so with reference to any construction work by outside contractors. Depending on the conditions, there may be a half dozen individual zones, each of which has its own special identifying button. The added safeguard of a list of persons authorized to enter the zone is posted conspicuously, and certain persons are instructed to continuously check those on duty in such locations. All employees are under instructions to report and apprehend any person in their area who has not been specifically authorized to be in such lo-

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Panel Heating Studies At Cornell

By C. O. MACKEY, M.E. '26

Professor of Heat Power Engineering

DURING 1943, preliminary studies of panel heating were made at Cornell in a program supported by the Consolidated Edison Company. The work was carried out under the direction of a Research Committee on Panel Heating with Dr. Norman S. Moore, Professor of Clinical Medicine, as Chairman. It was the original purpose of the study to investigate the various physiological, psychological, and physical factors relating to the comfort and economy of radiant heating and cooling. A study of physiological and psychological factors would require the use of human subjects in test rooms of a common size and furnished in the usual manner. Although the College of Engineering has a constant temperature room in West Mechanical Laboratory which is 26 feet by 29 feet by 12 feet, adequate in size to enclose such a test room, present conditions make it possible to obtain the many materials and instruments necessary in a full-scale study. Elimination of the physiological and psychological factors leaves only the physical or engineering factors.

The physical environment created by different methods of heating may, however, be studied in a model room geometrically and thermally similar to the prototype. A heating system installed in an enclosure for the purpose of maintaining human comfort must control the rate of heat loss from the human body, and any scientific attempt to maintain comfortable conditions must be based upon a knowledge of the factors that affect the thermal environment. One of the first questions that arise in a study of heating without the use of human subjects is "what factors define the physical environment?" For example, in comparing the economy of different methods of heating a model room, how may we be sure that each method is creating the same physical environment? Commonly, we know that heating is often controlled from a thermostat sensitive to air temperature; this device is immediately seen to be inadequate when we realize that the temperature of the air is only one of the variables constituting the physical environment. The engineer can provide an environment with an air temperature of 50°F which is just as comfortable as another with an air temperature of 70°F or as one with an air temperature of 90°F. The engineer doesn't provide the outdoor environment at Sun Valley, but we all remember pictures of beautiful skiers clad in bathing suits in apparent comfort.

THE AUTHOR

Professor Mackey

OVER nineteen years ago Professor Charles O. Mackey started teaching at Cornell. That was two years prior to his graduation from Sibley College in 1926. Since that time he has advanced rapidly in the Heat Power Department, being made a full Professor in 1936.

Aside from his teaching duties, he has done considerable work as a consultant in air-conditioning and refrigeration. He has worked for the Detroit Edison Company, Eastman Kodak Company, and the Carrier Corporation.

Physical Environment

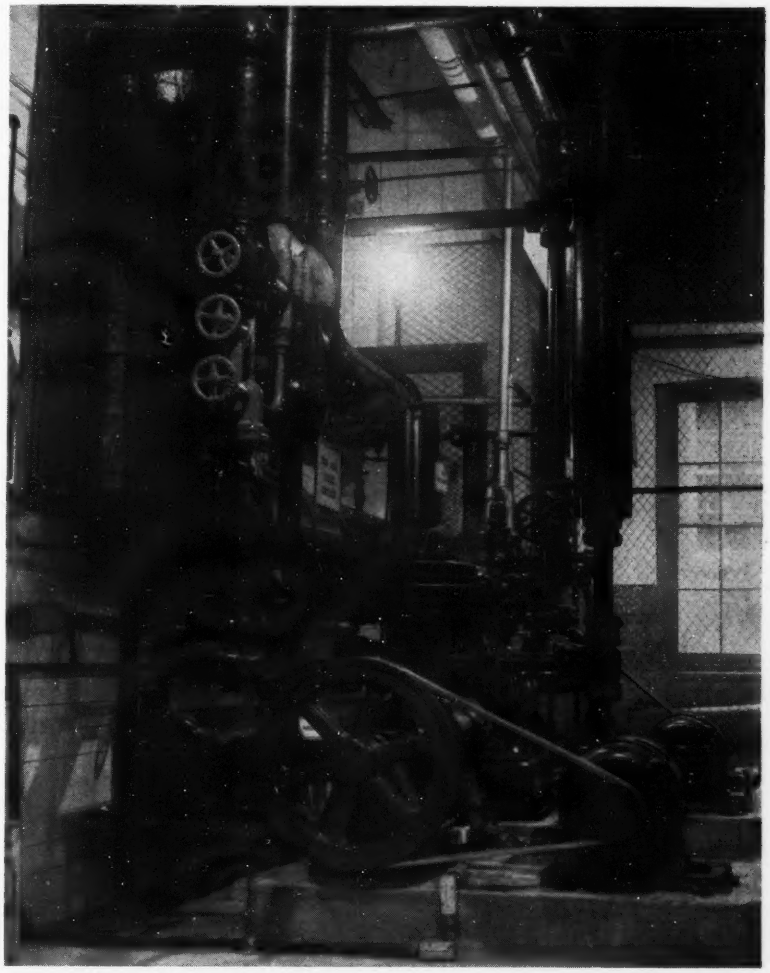
The physical environment is made up of a convective environment, a radiant environment, and an evaporative environment. In the absence of any work done by the human body, the difference between the energy released by metabolism and the heat stored in the body due to temperature rise must be balanced by the quantity of heat removed from the body by (1) convective heat transfer to the surrounding air, (2) radiant transfer to surrounding solid surfaces, and (3) evaporation of moisture from wet body surfaces. The variables affecting rate of heat loss by convection are air temperature, air velocity, average temperature of skin and clothing, and body area exposed to convective heat transfer.

In an attempt to define the radiant environment, engineers have used the term *mean radiant temperature.* The surfaces of common building materials and room furnishings like ordinary paint, plaster, glass, wood, and wool absorb between 90 and 95 per cent of the incident radiant energy which is emitted by other surfaces at moderate temperatures; it is customary to assume that these surfaces are

"black," i.e., that they absorb all incident radiant energy. The rate of exchange of radiant energy between the body surface and any one room surface, like a cold window, for example, is affected by the radiating area and emissivity of the human body, the average temperature of the skin and clothing, the temperature and emissivity of the inside surface of the window, and the angle factor, or the fraction of the radiant energy emitted from the human body which is in such direction as to be intercepted by the window. The various surfaces in a room are at different temperatures; the temperature of the inside surface of an exterior wall differs from the temperature of the surface of an inside partition, or from the temperature of a window surface. For "black" enclosing surfaces, the mean radiant temperature of any environment having non-uniform surface temperatures is defined as the uniform temperature of a "black" enclosure with which a human body would exchange energy at the same rate by radiation as in the actual environment. Mean radiant temperature lumps the effects of respective surface temperatures and angle factors into a single variable. In a given enclosure with "black" surfaces, the mean radiant temperature will vary with the position of any one enclosed human body because the angle factor from the body to any room surface will change as the position of the bodv changes. Furthermore, since all human bodies do not have the same shape, the mean radiant temperature of any enclosure is not precisely the same for all humans who might stand or sit in the same floor area. In short, an enclosure with unequal surface temperatures has not *one* but *many* radiant temperatures.

Evaporation of Moisture

Since the heat required to evaporate the moisture from the wet surfaces of the body comes from the body, the process of evaporation helps to rid the body of some of the energy released in metabolism. The rate of such heat loss depends upon the extent of wet surface, the temperature of the skin, the partial pressure of the water vapor in the surrounding air, and the movement of the air relative to the body. Experiments in partitional calorimetry conducted with human subjects at the Pierce Laboratory of Hygiene indicate that, in the range of environmental variables maintained for comfort in the heating season, the rate of heat loss from the human body by evaporation of moisture remains nearly constant. For a given dry-bulb temperature of the air, as the relative humidity decreases, the partial pressure of the water vapor in the air decreases, and the rate of evaporation per square foot of wet area increases. At the same time, there is a physiological control of sweat secretion which has the affect of cutting down the wet area of the body so that the product of wet area and rate of evaporation per square foot of wet area remains substantially constant. The important significance of this result, as far as investigations of heating in a model room are concerned, is that no attention need be paid to relative humidity as a variable in the physical environment. It is true, of course, that in warmer thermal environments, like those common in summer weather, the rate of heat loss by evaporation changes with environment with the result of holding the skin temperature substantially constant until evaporative regulation breaks down.



Compressor unit supplying constant temperature room.

Similar Environments

Two physical environments may be said to be the same when the combined rates of heat removal by convection, radiation, and evaporation of moisture from the human body are the same. In the range of environmental variables to be investigated for the heating season, the rate of heat loss by evaporation of moisture has been shown to remain constant. Two physical environments in this range are, therefore, the same when the combined rates of heat loss from the human body by convection and radiation

(Continued on page 20)

Riding The Rails

By MARGUERITE HAVEN, ME '45

THIS is the oft-told story of what happens when a father gives his son a model railroad train for a Christmas present. Yes, you've guessed it—the boy loses interest after the holidays, and the father takes over.

Out of this humble beginning came the South Hill Railroad, an up-and-coming model pike in the cellar of W. J. Purcell, C.E. '26, of 517 Hudson Street, Ithaca, N. Y., who is an instructor in engineering drawing at Cornell. President Purcell of the South Hill Railroad is assisted by the vice-president in charge of engineering, Norman R. Bell, an electrical engineering instructor in the Cornell Naval School.

Aiding in the construction work were Ted Rogalski of Buffalo; Dick Ryon '43, now with Goodyear Co.; Ed Hauff, ME '46; Don Townsend of the Ithaca Gun works; Bernie Moore of Head's Camera Shop; Walker Richardson, ME '46; Herb Luxon, AE '46; Stan Reiter, ME '46; Bill Isham, EE '45; Ferdinand Herlitz, AE '46; and Bob Conger '43, an assistant in chemistry.

The HO gauge rails were laid on 14,000 ties (48 to the foot). One hundred fourteen route feet, 300 track feet, 41 turnouts, 1 three-way lap switch, 1 double slip switch, and 1 crossing make up the layout. The crossing, turnouts, and switches were all made by Mr. Purcell. In addition to these, the railroad has acquired several automatic turnouts made from old auto generator cutouts.

Power Supply

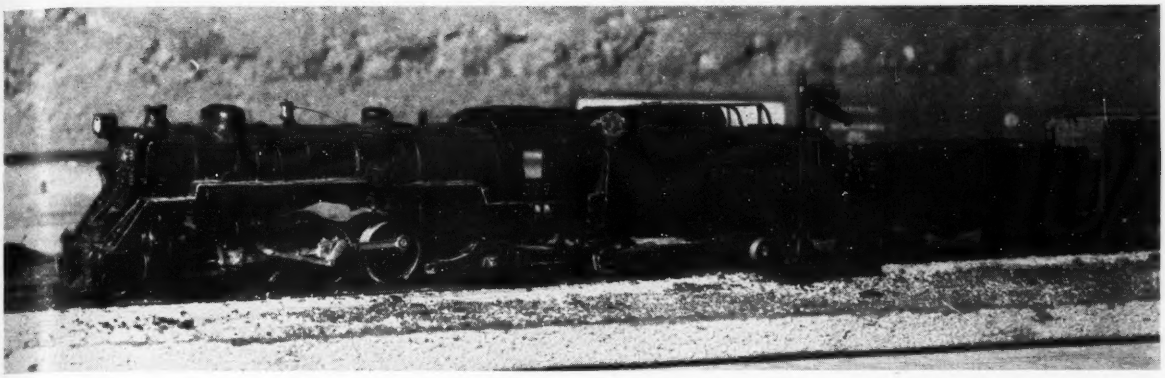
The electricity for the railroad is supplied by six-volt automobile storage batteries. The direct-current supply enters at the right wheels of the locomotive and leaves through the left wheels of the tender. The opposite wheels are insulated to prevent short circuiting. Since the engines are driven by permanent-magnet motors, reversing is effected by simply interchanging the track polarities. There are two rheostats to vary the speeds of the trains. Eventually, all turnouts will be electrically operated from a three-board control system, which will allow five trains to be operated at once. There will also be an automatic set-up, such that two trains can run in opposite directions on the main line without attention, and not collide; one train will stop automatically at a siding and allow the other to pass. There will also be individual train control with superimposed route control. With this new system, 12 volts will be employed for the power.

Vice-president Bell has drawn the complete layout for the model railroad, including trackage, signaling, and wiring. The railroaders are following this in their work, and will also use, for scenery, a contour map to be drawn by Ed Hauff. They are members of the Union Central system, a group of three cooperating model railroads. The other two are the Moon Valley, which Mr. Bell will someday operate, and the Lehigh Branch, operated by Louis Beuhler of Allentown, Pa. All of these railroads have been registered with the *Model Railroader* magazine, which acts as the Interstate Commerce Commission of model railroading.

Townsend Yard

A Trip On The Road

But let us take a trip on the railroad. We shall board the train at Hudson City, the largest city on our route. At this terminal there are two through and three stub tracks. A large and modern passenger station is under construction. Just east of Hudson City we pass through South Hill Junction and then come to Valley Junction. If we were on another train, we might go straight to Moon Valley, but our train is turning, and we go through a tunnel and come out at Buttermilk Falls, where there is a stone quarry. Crossing a bridge, we come to South Hilton. Just outside of South Hilton is located Townsend



South Hill Railroad Pacific Engine

Yard. This is a large freight yard with five classification tracks, receiving and departure tracks, a storage track, a passing siding, and the main line. Here trains are made up and broken down, and cars are switched according to destination.

Continuing our trip, after a last look at the busy switch engine, we speed through Nancy Manor, across another river, and into Summit, the highest point of the system. Passing through Summit and back toward Hudson City, we take another route. At South Hill Junction, our train turns off the high iron and veers around into Six Mile. We cross another bridge, go through a long tunnel, and make a stop at the small rural community of Cayuga. After picking up a few passengers, we cross a river, go through a small tunnel, and enter Enfield, a medium-size manufacturing town. The next stop on our journey is Empire, terminal for the branch line, and the end of our run. We pull into the station and step out of the cab into the yards. Over to one side is an engine escapement track, and next to that is a sleeper siding. We also see three sorting tracks. Our engine backs off through the escapement and switches to another track, where it takes on coal and water and dumps its ashes. The hostler then takes it onto the turntable and into the roundhouse. Even as our tired engine limps in, we see a fresh locomotive move out of the engine terminal onto the parade track, groomed for the return journey. But let us turn our attention to the rolling stock.

All of the locomotives and cars have been constructed entirely by hand or built up from kit. Mr. Bell's Moon Valley Railroad, operating on the South Hill track, has to its credit one passenger engine, a Pacific 4-6-2; one freight engine, a Mikado 2-8-2; and a six-wheel switcher, 0-6-0. Motive power of the South Hill line includes a high-stepping Pacific, a second Pacific, and a switcher under construction. The numbers given are the Whyte designations, which tell the wheel setup. For example, a Pacific engine is always specified 4-6-2, which simply means 4 leading wheels, 6 large driving wheels, and 2 trailing wheels. Passenger engines almost invariably have 4 leading wheels for stabilization at high speeds. The Mikado's eight drivers are smaller and carry a larger percentage of the engine weight, both of which make for pulling power at a sacrifice of speed.

Rolling Stock

Altogether there are five passenger coaches and one Pullman car. Two of the coaches are combined passenger and baggage cars. The Pullman is an authentic model of the "Scenic Ravine," often seen outside of the Lehigh Valley station at Ithaca. Mr. Purcell has even detailed his cars with miniature seats and compartments which you can see through the windows. The Moon Valley and South Hill roads also own 11 refrigerator cars, 9 box cars, 4 coal cars, 4 gondolas, 4 flat cars, 3 stock cars, one tank car, one pickle car, a crane unit, (including boom car, crane, and tender), and 3 cabooses. Mr. Hauff insists that his trolley car be counted, too.

The cars should weigh about four ounces for satisfactory operation, and some of them must be weighted. Mr. Bell has hand-lettered several of his cars, an intricate job since the cars are only about six inches long. Most of the cars, however, have ready-made sides printed on heavy cardboard. Many of them have automatic coupling and uncoupling, a feature which will be extended to all cars eventually.

The Turntable

The turntable which serves the roundhouse has a concrete pit which was cast in a pattern made by Mr. Howard Curtis of the Cornell materials processing department. The turntable will be run by electricity when finished. Mr. Purcell has built a rural-style passenger station and a water tower, both shown in an accompanying picture. There are several bridges in the system. Mr. Hauff designed and built a skew arch in plaster-of-Paris, making it resemble concrete very closely. In fact, the operators say the bridge looks more like concrete than the *real* concrete turntable pit.. Another bridge has been built by Mr. Bell and Mr. Ryon as a Warren steel truss. (See accompanying photograph.) Sooner or later all of the benchwork will be hidden by scenery. There will be hills, trees, water, rocks, buildings, and even people to make the layout look very realistic. In the meantime, with almost a year of effort behind them, the brass hats are looking forward to a year which promises loads of fun in the "engineers' hobby". The one evening a week left from wartime jobs has shown satisfactory results, and the future looks bright.

So come and take a ride on the South Hill! Your ticket is just a love for track and trains and a special feeling for the look of a strong engine highballing down the main with a heavy train. And best of all, this is one railroad where there is no restriction on travel in wartime!

ALUMNI NEWS

Dean Hollister

DEAN S. C. Hollister of the College of Engineering was recently elected a director of the American Society of Civil Engineers. He will represent New York State and a section of Canada during his three year term. Dean Hollister was the first president of the Indiana district of the ASCE, the secretary of the Philadelphia section, and a member of the national executive committee of the structural division of the Society in 1921.

Also installed as a director of the Society last week in New York was Frank C. Tolles C.E. '05. Mr. Tolles is from Cleveland, Ohio.

Publication

IN the *Bell System Technical Journal* for this quarter K. G. Van Wynen, EE '36, describes a graphical method for the solution of impedance problems in communications work. The article, "Design of Two-Terminal Balancing Networks", gives examples of typical applications of the method, which is suitable where extreme accuracy is not required.

The mathematical analysis and proper methods so derived for the hobbing of helical and worm gears are described in the December, 1943, issue of the *Journal of Applied Mechanics* in an article by H. Poritzky, Ph.D. '27, and D. W. Dudley. Numerous charts and tables are provided for the solution of gear problems.

F. W. Cuffe

F. W. Cuffe, M.E. '19, head of education activities for the General Electric Company's Aviation Division, died in Cleveland, Ohio, last month while he was on a trip for the company.

A native of London, England, Cuffe attended a technical school in Toronto before he entered the College of Engineering in 1915. While at Cornell he belonged to Theta Alpha fraternity and was a member of the Student Army Training Corps.

From his graduation to his death Cuffe was associated with the General Electric Company. He worked in various divisions of the company at Stratford, Ontario, Chicago, Cleveland, and Schenectady.

Best Paper

HERMAN Haperin, M.E. '20, has received the award for the nation's best paper on engineering practice in 1942 from the American Institute of Electrical Engineers. The paper was entitled "Load Rating of Cable—II." While at Cornell Mr. Halperin received the fifth Sibley prize in 1919. Following his graduation, he worked for the Cincinnati Gas & Electric for a year and since then has held various positions with the Commonwealth Edison Company. He is best known at present for his work relating to underground power systems.

Professor Martin

PROFESSOR Clarence A. Martin '88, Architecture, Emeritus, former Dean of the College of Architecture, died January 5 at his home in Sarasota, Florida, where he had lived since his retirement in 1932. Professor Martin became an instructor in 1894, assistant professor in 1895, and attained full professorship in 1919. He was Dean of the College from 1908-19 and was Acting Dean in 1931-32 before becoming Professor Emeritus. Professor Martin received his DSc. from Colgate in 1918, was a member of Phi Gamma Delta and Tau Beta Pi, and from 1921-25 was secretary-treasurer of the Association of Collegiate Schools of Architecture.

Heads Railroad

MAJOR General Charles P. Gross M.E. '21, Director of Transportation of the Army Service Forces, was given direct responsibility for operations of the railroads during the recent railroad crisis. He was under the immediate supervision of Lieut. Gen. B. B. Somervell, who was designated by Secretary Stimson to take over the railroads.

General Gross received the degree of Mechanical Engineer here in 1921, but attended Cornell from 1906-10. Later he was a cadet at West Point for four years graduating in 1914. He has served as an officer in the Corps of Engineers for a quarter-century. Last year he was with the Sixth Army Corps in Providence, R. I.

War Work

TWO more firms in which Cornellians are officials have been recognized for excellence in war production. The Mason Can Co., East Providence, R. I., has added a star to its Army-Navy burgee denoting a second six months of meritorious work. Walter Gompertz '29 is vice-president and general manager of the company.

Western Newell Manufacturing Co., Freeport, Illinois, of which Maurice F. Smith M.E. '20 is secretary, has received the "E" production award. The firm, manufacturing drapery hardware in peacetime, is now making machine gun belt links.

NEWS OF THE COLLEGE

A.S.M.E.

THE Cornell Student Chapter of the A.S.M.E., in conjunction with the Ithaca section, held its first meeting of the semester on January 26.

Lieutenant Commander G. B. Gilbertson, head of the Ordnance Department of the Naval Training School, spoke on the commissioning of ships. He told how some PC boats are built on the Cumberland River in Tennessee, and then floated down to a Naval base at the mouth of the Mississippi, where they load on supplies and men for shakedown cruises. Commander Gilbertson stressed the importance of the first few cruises, both from the standpoint of "working in" inexperienced crews, and "working out the bugs" of a brand new ship. Since a preponderance of V-12 students were in attendance at the meeting, Commander Gilbertson found himself answering many questions about engineering problems encountered in the building, launching, and commissioning of Naval vessels.

At the conclusion of this part of the meeting, the Student Chapter held an organization meeting. The following officers were elected:

Chairman, Alexander M. Beebee, V-12
Vice-Chairman, Frank Swingle, V-12
Secretary-Treasurer, Horatio W. Bacon, ME '44

Professor G. H. Lee was elected Honorary Chairman. He succeeds Professor L. T. Wright, who has served in that capacity for the past three years.

Professor Manning

ON Friday, January 7, Associate Professor Melvin L. Manning of the School of Electrical Engineering gave an illustrated lecture on "The Lightning Generator and Its Application to Transformer Testing" before members of the Ithaca section of the American Institute of Electrical Engineers.

This talk by Professor Manning, who is Director of the High Voltage Laboratory, was of a practical nature for the electrical engineers because the lightning stroke generator seeks out flaws in the transformer, heart of an a.c. system. It is the ability of the modern transformer to withstand lightning voltages which makes it superior to the transformers of a decade ago. Use of the lightning generator has enabled the development of better insulating materials and protective devices.

Professor Manning, after graduating in 1927, was employed by Westinghouse. Here he completed

Professor M. L. Manning

the Graduate Student Course and was assigned to the Industrial Motor Section. Later he received the M.S. degree in electrical engineering and continued graduate work under the University of Pittsburgh Westinghouse Plan. From 1937 to 1942 he was supervisor of the high voltage laboratories of the Westinghouse Co., Transformer Division, Sharon, Pa., as well as Westinghouse lecturer in electrical engineering on the staff of the University of Pittsburgh. Recently he joined the staff of Cornell University.

Eta Kappa Nu

ETA Kappa Nu, honorary electrical engineering society, is reconditioning some old electrical equipment of the University to be placed on display in Franklin Hall's computing room. The project will be completed by the end of February. The equipment consists of several models of apparatus for which patent applications were being made about 1900. They were used as evidence in the disputes which arose over the applications.

Tau Beta Pi

Three faculty members and eleven students were elected to Tau Beta Pi, national honorary engineering society, on January 13. They are the following:

Prof. H. E. Baxter, Arch., '10
Director W. L. Malcolm, C.E.
Prof. C. W. Mason, Chem.E.
Jack R. Anderson, ME, '44
Joseph E. Bambara, EE, '44
Raymond C. Baxter, ChemE, '44
Adrien A. Duncan, CE, '44
Lawrence Himmel, ChemE, '44
Charles K. Kerby, Jr., CE, '44
Edwin R. Kramer, Arch, '44
William Nachbar, ME, '44
William J. Rothfuss, ChemE, '45
Raymond A. Van Sweringen, ME, '44
Laurance A. Weber, EE, '44

This election increases the student membership of the Cornell chapter to 44.

A very enjoyable party was held January 8, at the Phi Delta Theta house for the members and their dates. The chapter has been quite active this term and plans further activities before the term ends.

Naval Training School

NAVAL Training School at the University has announced that when the present sixteen-week courses in steam engineering and deck officer training are completed late in April, the program will be discontinued. This does not affect the training of officers in Diesel engineering, or the V-12 unit, which together comprise three-quarters of the School's registration.

The training of deck officers and steam officers began here more than a year ago, replacing a course in communications which was shifted to Harvard University. Graduates of the two courses, all of whom en-

(Continued on page 34)

PROMINENT

Mr. Beck

George Beck

"THE aim of the Project Laboratory is to indicate to the student in terms of personal experience the identity of engineering theory and sound practice." This statement was emphatically made recently by George Beck, newcomer to the E.E. faculty, in describing the course he teaches, Communications Project Laboratory. "Theory and good practice go together," he continued. "The student is given the opportunity of individual manipulation of theory and equipment to achieve specific results."

The aim of the Project Laboratory, is in short, to provide the student with a research project in miniature.

Practically all of his life, Mr. Beck has been in some way connected with the development and utilization of electrical equipment. Radio, sound and electronics—he has worked with each. Sometimes he has been concerned with a single part, and other times he has engaged in projects involving thousands of units. Here indeed is a man well fitted by background for the task assigned him.

When George was quite young, the Becks lived for a number of years in Europe. George was three when his family sailed for Europe, and no sooner had they landed at Hamburg, than Britain declared war on Germany. He disclaims all responsibility or even connection with the event. The Becks were unable to leave Austria-Hungary for five and a half years, due to the senior Mr. Beck's serious illness. Upon their return to the United States, they settled in New York. George attended school in New York, and, as he puts it, "my desire to make a fortune before the age of twenty-one caused me to leave school and go into the radio salvage business." From 1927 to 1932 his specialty was to salvage and to set up the procedures for reclaiming thousands of radio sets taken over from the bankrupt companies which were so numerous at that time.

His first position in the radio business, while still at school, was with a firm owned by Lee deForest, inventor of the vacuum tube and father of modern radio. Up until 1935, he was contractor and consultant for many salvage firms, and in that year became associated with the service department of Davega-City Radio in New York and was in charge of their communications and special equipment department for some time.

In 1939 Mr. Beck came to Ithaca to build and service radio, laboratory and amplifying equipment. His first direct connection with the University was in 1942 when he taught Engineering Science Management War Training courses in pre-radar work. During the time from 1939 to 1942, much of his work was con-

(Continued on page 30)

Albert Beehler, V-12

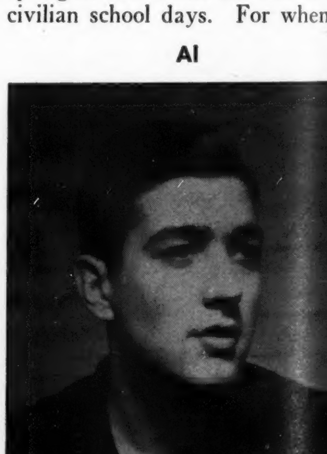
As he prepares to leave the University, Albert Beehler can look back and recall four happy and successful years at Cornell. As far as engineering at Cornell is concerned, Al's story begins when he was a student at Baltimore's Polytechnic Institute and became interested in the subject. He chose to study at Cornell as his father (A.B. '17) had done. Therefore, in the fall of 1940, which Al recalls as "the good old days", he entered Cornell as a candidate for a BME degree.

When questioned about scholastic matters Al will modestly intimate that studies come rather easily to him. Realizing the importance of extra-curricular activities, he pledged himself to Phi Gamma Delta and also enter the "Widow" business competition. Those together with his schoolwork kept Al's freshman year from becoming boring. The summer following his first year was spent as an instructor in small boat sailing at a camp on Lake Champlain. Al has a great fondness for sailing and is very skilled at it. A native of Baltimore, Md., he has had many sailing and fishing experiences on Chesapeake Bay.

At the beginning of his sophomore year, Al won the *Widow* competition and went out for the Soccer managership. Meanwhile, the war was progressing toward its first birthday, and the Navy had already inaugurated its reserve program. Influenced by his love of sailing and aided by his knowledge of small boat handling, he enlisted in the V-7 program in October, 1942.

During his junior year, Al was a very busy boy. He started in the fall by managing the soccer team. He was elected the business manager of the "Widow" and helped guide the financial policy of that publication. He was elected to Aleph Semach, the junior honorary society; Atmos, the honorary Mechanical Engineering organization; Kappa Beta Phi, a rather damp social organization; Sphinx Head, the senior honorary society; and finally Tau Beta Pi. With the advent of spring in 1943 came the end of Al's civilian school days. For when he

Al



ENGINEERS

returned in July for the summer term, he was placed on active duty by the Navy and stationed on the good ship Cornell.

Al has enjoyed the Navy training program. Always interested in meeting and talking to people, he says that the V-12 program has given him an opportunity to see many new faces and make new acquaintances. Eager to absorb knowledge about the Navy, he has made the most of his contacts with the more experienced Naval personnel who have been sent to Cornell. Along with his duties as an

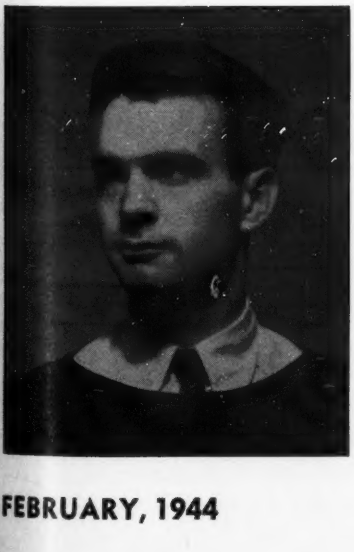
(Continued on page 32)

Adrien A. Duncan, CE

ADRIEN Alexander Duncan, CE '44, did quite a bit of traveling before he came to Cornell. Born in Havana, Cuba, he attended elementary school in Geneva, Switzerland, and DeWitt Clinton High School in New York City, with stopovers in Paris, Cleveland, New Orleans, and Buffalo. He started his higher education at Deep Springs Ranch school in California, and then entered Cornell as a student of city planning in his sophomore year.

"My work keeps me very busy, and I don't have much time for other activities," Dunc, as he is known here, claims, but in that little time he has run up an admirable record. He has been co-chairman of the Cornell unit of the Red Cross, a member of the Board of Managers of Willard Straight, vice-president of Pyramid, editor of "Transit", publication of Chi Epsilon, and acting president of ASCE. He kept up all this work, meanwhile keeping his grades high enough to warrant his election to Tau Beta Pi, Chi Epsilon, and Phi Kappa Phi, all honorary societies. He was also elected to Telluride Association, of which he was treasurer. A John McMullen Regional scholarship graces Adrien's record.

Adrien



Engineering, though Adrien's main study, is not his only interest. At Deep Springs School he was the official photographer, and to this time taking colored motion pictures interests him immensely. He likes hiking, swimming, sailing, and camping. Already he has climbed the highest mountain in the United States, Mount Whitney, and has taken hundred-mile pack-hikes through the Sierras.

While French is his native tongue, Duncan speaks fluent English, good Spanish, and "some German". At Deep Springs he took courses in sociology and psychology. He enjoyed Professor Kazekevich's course on Soviet economy here very much. Right now he is taking city planning courses in the Architecture school along with his regular C.E. studies.

For three years while at Deep Springs he worked half the time and studied the other half. In the summer of '42 he worked as a surveyor during the construction of the Sampson Naval Training Station. He had already practiced surveying air fields and irrigation ditches as part of his ranch work in California.

Adrien's future is very bright. This Tuesday, February 22, he shall be married to Miss Lenore Kennedy, Arts '44. Next term they will set up house in Cayuga Heights, while he instructs ASTP students in elementary engineering courses, at the same time continuing his own studies. After he graduates in June, Adrien intends to apply for a commission in the Sea-Bees, and after the war he wants to work as a municipal city-planning official.

Bob

Robert S. Rochlin, EE

"I am happy to inform you that at a recent meeting of the Committee on Admissions your application for admission to the courses in Electrical Engineering was approved." This letter combined with the award of the State and Cornell scholarships brought to Cornell in the fall of 1940 one freshman of the usual green variety listed as Rochlin, Robert Sumner EE '44, Yonkers, New York. Soon, however, this distinguishing color disappeared as Bob rapidly became oriented to campus life and discovered the varied extra-curricular activities available to him. He became a member of the Public Affairs Committee of CURW and was later elected chairman of the group. The ENGINEER gained a valuable addition to its staff when Bob was elected to the editorial board in his Freshman year. His status gradually increased until as a senior he held the position of editor-in-chief. He became a member of the American Institute of Electrical Engineers, the Institute of Radio Engineers, and was secretary of his house, a cooperative organization known as Algonquin Lodge.

However, Bob's Cornell career has been far from "all play and no work" as evidenced by his receipt of a McMullen scholarship upon completion of his freshman year, and the fact that he has shown a decided affinity for the Dean's List during the past eight semesters. He has been elected to the honorary societies of Tau Beta Pi, Eta Kappa Nu, and Phi Kappa Phi, and is

(Continued on page 32)

REVIEWING STAND

Municipal and Rural Sanitation, 3rd. Edition, V. M. Ehlers and E. W. Steel McGraw-Hill Book Co., New York and London, 1943.

Sanitary Engineering, in the broad sense, constitutes the control of unfavorable environmental conditions and the adjustment of environment to man's needs. To include complete and detailed information on all phases of the subject would require a large library. This book was written to satisfy the specific needs of the engineer who has neither the time or the desire to cover the subject in great detail.

A vast amount of information, including practically all phases of sanitation, has been condensed into this one volume of 434 pages and is written in the clear, concise language of the engineer. In addition to a brief coverage of water and sewerage problems, fundamental information on communicable diseases, public health organizations, industrial hygiene, housing, plumbing, lighting and ventilation, vital statistics, refuse collection and disposal, fly, rodent, and mosquito control, swimming pools, disinfection, milk and food sanitation are included.

The latest edition has been corrected to include the most recent development in ventilation and air conditioning, industrial hygiene, mosquito control and refuse disposal. The chapters on milk and food sanitation have been carefully expanded. These subjects have taken on added significance due to world conditions where thousands of men are stationed in unfamiliar surroundings and where sanitary control must be instituted instead of merely maintained, as it so often is in this country.

An excellent bibliography of specialized textbooks, the total of which represents a relatively complete coverage of the subject of environmental control, has been included at the end of each subject. To mention other texts, which is somewhat unique in textbook writing, in no way detracts from the abilities of the authors or decreases the value of the text. On the other hand, the book not only furnishes adequate information for the average engineer, but should save a great deal of time for those engineers who have a specific need for a detailed discussion of some particular subject.

While the book was intended for a reference for the sanitary engineer and as an elementary text for the student in sanitation, it has been found to be of immense value to members of other professions, such as public health officers, sanitary bacteriologists, and entomologists, as a source of information on sanitary problems outside the limits of their specialized trainings.

Howard M. Gifft,
Assistant Professor of Civil Engineering

Analysis of Rigid Frames, by A. Amirikian (Cornell '23) United States Government Printing Office, Washington, D. C. 1942, 396 pp., $1.00

The content of this book is more completely described by its subtitle, "An Application of Slope Deflection," than by its title. Except for three pages devoted to the moment distribution method, the entire book deals with slope deflection only. The classical methods of frame analysis, such as Castigliano's theorem, the fundamental properties of the elastic curve, and others, are not mentioned anywhere.

About one quarter of the text is devoted to a discussion of the fundamentals of the slope deflection method. It represents a clearly written outline of the idea of this method and should be easily understood by anyone familiar with the essential concepts of strength of materials. This section covers familiar ground with one rather important exception: the chief advantage of the slope deflection method, as compared with the older classical approaches, is that it reduces the number of simultaneous equations arising in the analysis of more involved frames, such as multi-story, multi-span bends. But even this method often results in a great number of such simultaneous equations the rigorous solution of which is exacting and time-consuming. Mr. Amirikian develops a method of solving such simultaneous equations by successive approximations. This method is not fundamentally new mathematically and bears some resemblance to the moment distribution method. But, to the reviewer's knowledge, the application and adaption of the method to slope deflection is given here for the first time and should be of great value to the designer of more complicated frames. The time saving achieved by this approach is very considerable and accuracy is not sacrificed within practical limits.

The main body of the book consists of the detailed discussion of about forty frames of different shapes and loading. In this section, it is very apparent that the book was written chiefly as a compilation of forty-four of the author's articles published at various times by the Bureau of Yards and Docks, U.S.N. Most of these examples do not contain anything new in addition to what was discussed in the introductory part of the book. The chief use of this section may be confined to the designer who happens to meet, in his practical work, a frame of exactly one of the shapes discussed in the book, and who, instead of carrying out the analysis himself, may then use Mr. Amirikian's results directly. For the student, as an illustration of the method, one quarter of the examples would have been ample.

The last part of the book is devoted to the discussion of a number of special questions, such as the displacement of foundations, semi-rigid framing, axial and shearing deformations. A great number of tables enhance the value of the book for the practical engineer.

One wonders why a number of questions of practical importance are not elaborated in the text. The increasing use of rigid frame bridges calls for a simple method of computing influence lines by the slope deflection method. No attention is given to this question, which will

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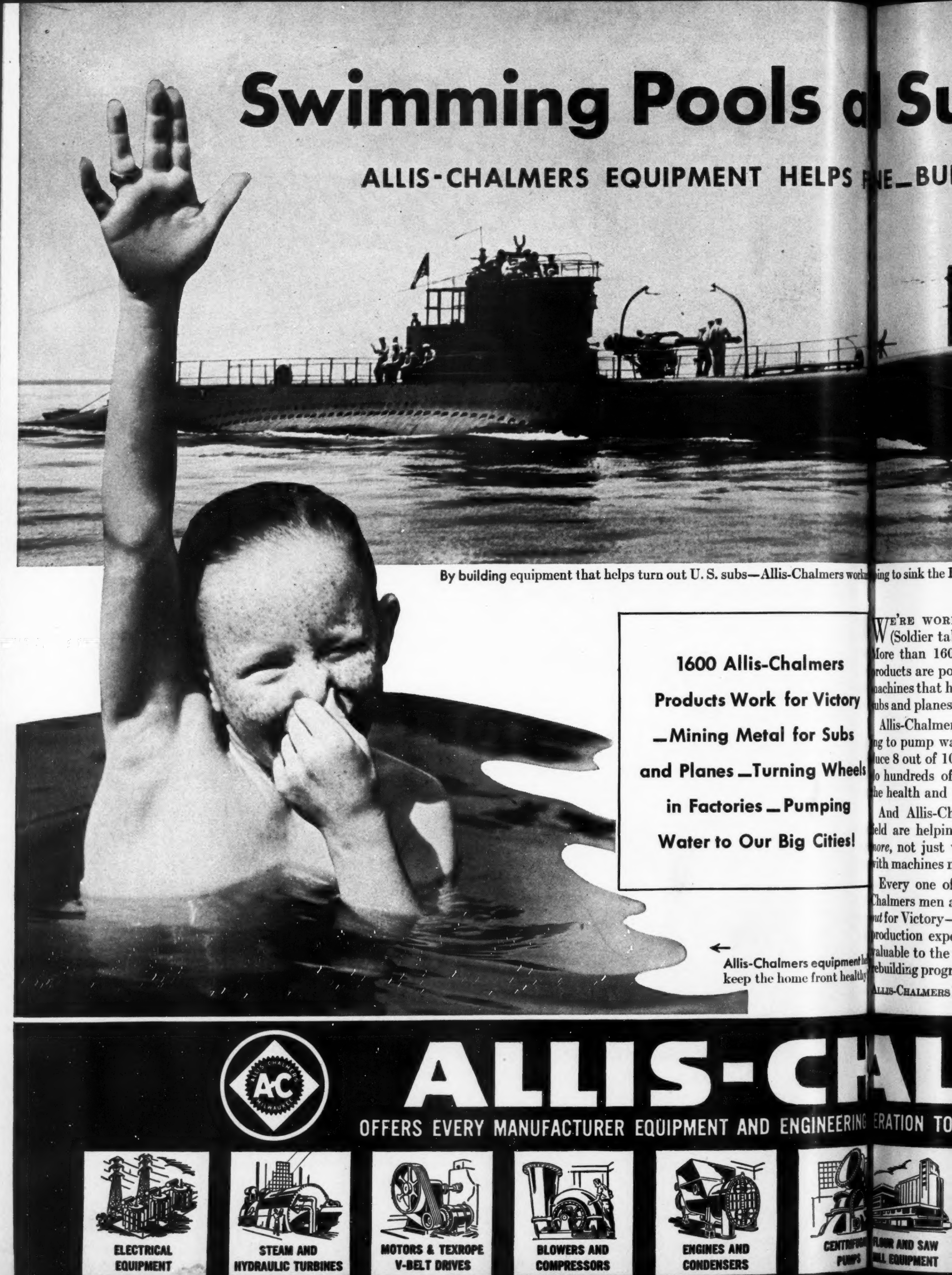
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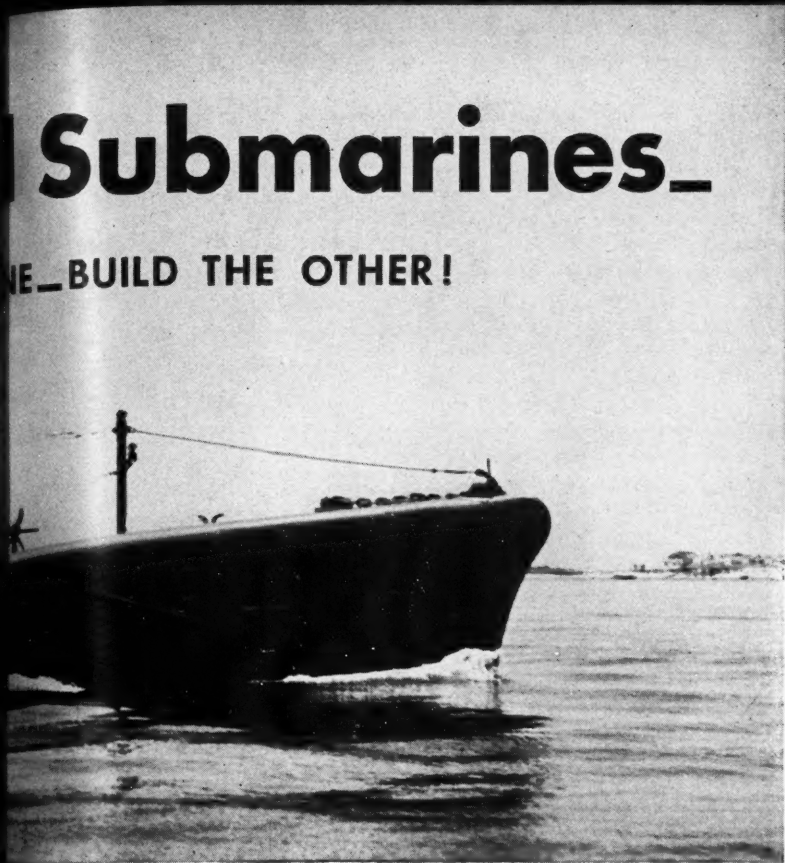

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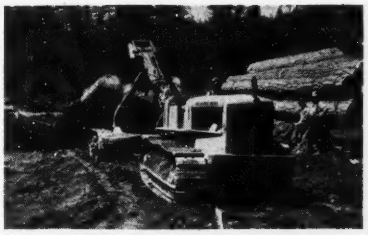

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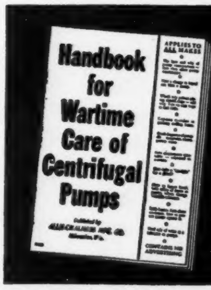

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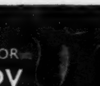

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Panel Heating

(Continued from page 9)

are the same. By steps too long to include completely in this article, it may be shown that such a physical environment may be defined by a term called *operative temperature.* Assume there exists a "black" thermal environment in which the temperature of the air is the same as the mean radiant temperature and in which the air velocity has some arbitrarily assigned standard value. Let the total loss of heat from a given human body in the standard environment be at the same rate as in the actual environment when the average temperature of the skin and clothing is the same in both; the operative temperature is then defined as the air temperature or mean radiant temperature of the standard environment. The accompanying table gives several different environments which have the same operative temperatures, or in which there would be the same combined rate of heat loss from the human body by convection and radiation with the same average temperature of the skin and clothing.

Temperature of Air, °F	Velocity of Air, ft/min	Mean Radiant Temperature °F
70	15 ("Still" Air)	70
70	100	87
80	15	61
80	100	64
50	15	87
50	100	133

In the use of the model room, then, the first step in comparing different methods of heating is to have the same physical environment, or the same operative temperature, in all of the tests. This insures that the environments being compared are ones in which the combined rate of heat loss by convection and radiation from the human body would be the same. After engineering data concerning economy and uniformity of operative temperature in the zone of occupancy with different heating methods are obtained, the tests would have to be followed by tests in rooms constructed to full scale in order to obtain physiological and psychological data.

Engineers familiar with the A.S.H.V.E. effective temperature may wonder how it compares with operative temperature. Operative temperature is not a physiological temperature scale, because no attempt is made to introduce the question of sensation of warmth or cold. There is some evidence, however, that the average temperature of the skin and clothing, which depends on operative temperature, may be correlated with the sensation of warmth or cold. By contrast, effective temperatures were found by asking human subjects to compare their feelings of warmth or cold. Effective temperature is of little use, however, in the study of panel heating or radiant heating, because it does not include the effect of mean radiant temperature. The subjects were enclosed in a test cubicle in which the surface temperatures were about the same as the temperature of the air. Effective temperature falls short as a measure of either physical or physiological environment when there are any surfaces in an enclosure which are not at air temperature, whether these surfaces be cold windows or heated panels.

Engineering Calculations

Engineering calculations necessary in the study of heating methods for the purpose of determining the required rates of heat supply and the uniformity of the physical environment created may be based upon a method of heat balances explained by Raber and Hutchinson in Heating, Piping, and Air Conditioning, August, 1941. This method consists of writing one equation which specifies the desired operative temperature at some one point in the room, one equation expressing the heat balance on each different surface in the room except the surface of any heated panel, and one equation giving the heat balance on infiltering and exfiltering air, which is assumed to be heated from outdoor temperature to indoor temperature by convective heat transfer from the respective room surfaces. In the case of a room heated by the warming of one panel, the number of linear equations which will result is seven plus the number of separate window surfaces. These equations may then be solved, simultaneously, for the temperatures of all surfaces of the room and the temperature of the indoor air. The required rate of heat supply may then be found, and the uniformity of the environment may be sampled by calculating the operative temperature at selected points in the zone of occupancy. To simplify the solution of these and other simultaneous linear equations, Dr. L. T. Wright, Jr., developed an ap-

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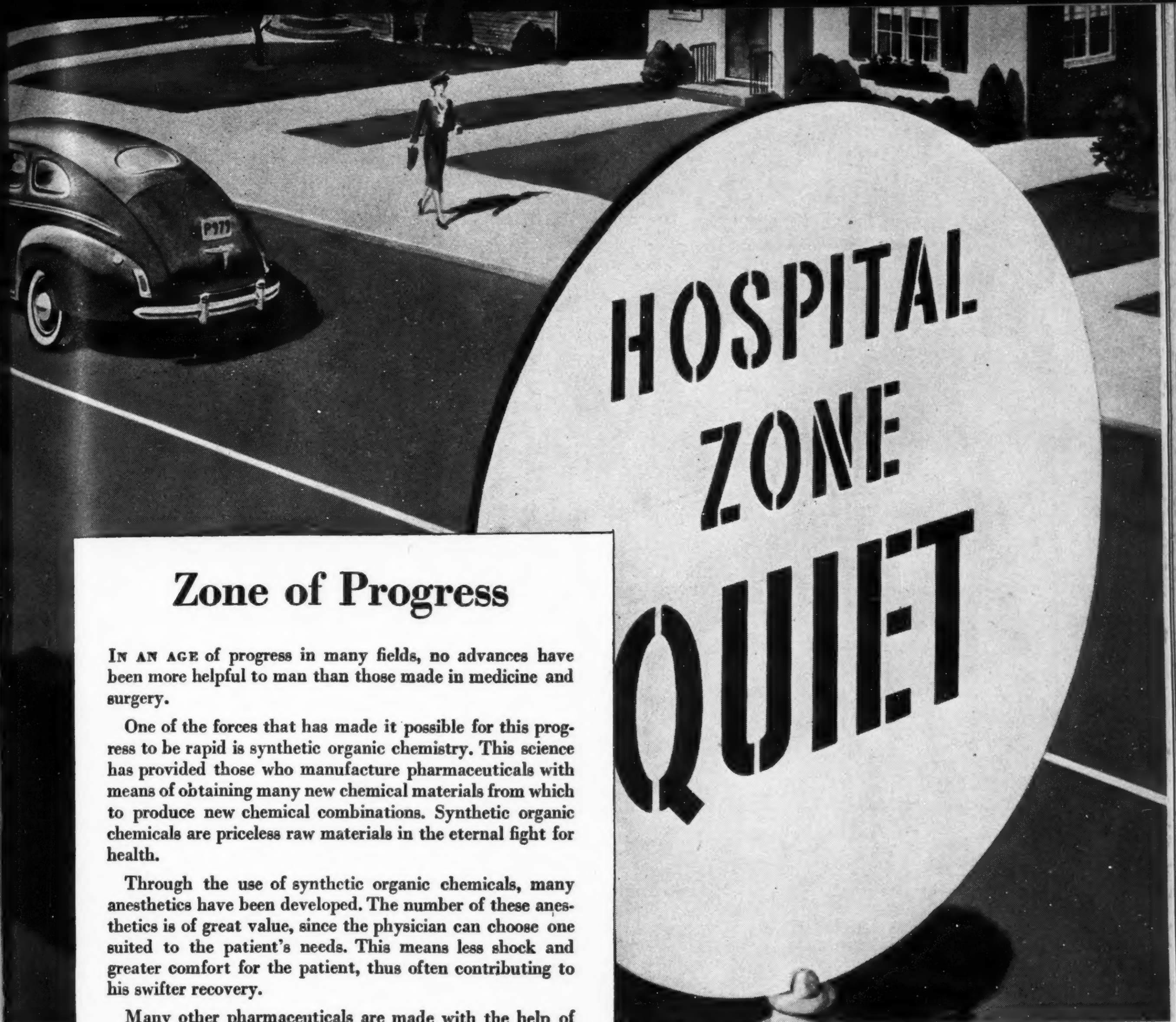

Zone of Progress

In an age of progress in many fields, no advances have been more helpful to man than those made in medicine and surgery.

One of the forces that has made it possible for this progress to be rapid is synthetic organic chemistry. This science has provided those who manufacture pharmaceuticals with means of obtaining many new chemical materials from which to produce new chemical combinations. Synthetic organic chemicals are priceless raw materials in the eternal fight for health.

Through the use of synthetic organic chemicals, many anesthetics have been developed. The number of these anesthetics is of great value, since the physician can choose one suited to the patient's needs. This means less shock and greater comfort for the patient, thus often contributing to his swifter recovery.

Many other pharmaceuticals are made with the help of synthetic organic chemicals. Anti-malarial substances, synthetic adrenalin, man-made vitamins, anti-pyretics (to cut down fever), many kinds of sedatives, vehicles in which drugs are administered, and solvents used in extracting drugs from natural sources are some of the medicinal aids made possible by these chemicals.

Carbide and Carbon Chemicals Corporation, the Unit of UCC which pioneered in the field of synthetic organic chemistry, has made more than 160 synthetic organic chemicals available in commercial quantities. Many of these chemicals are important in various ways in the pharmaceutical industry.

Pharmaceutical manufacturers, and research and technical men in chemical and allied industries, are invited to send for a copy of the 100-page booklet P-2, "Synthetic Organic Chemicals," which technically describes the properties and some of the uses of these chemicals in pharmaceutical and other fields.

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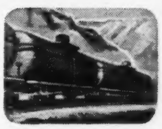

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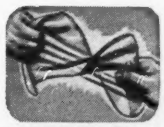

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Panel Heating

(Continued from page 20)

proximation method which has been presented in Bulletin No. 31 of the Cornell University Engineering Experiment Station (April, 1943).

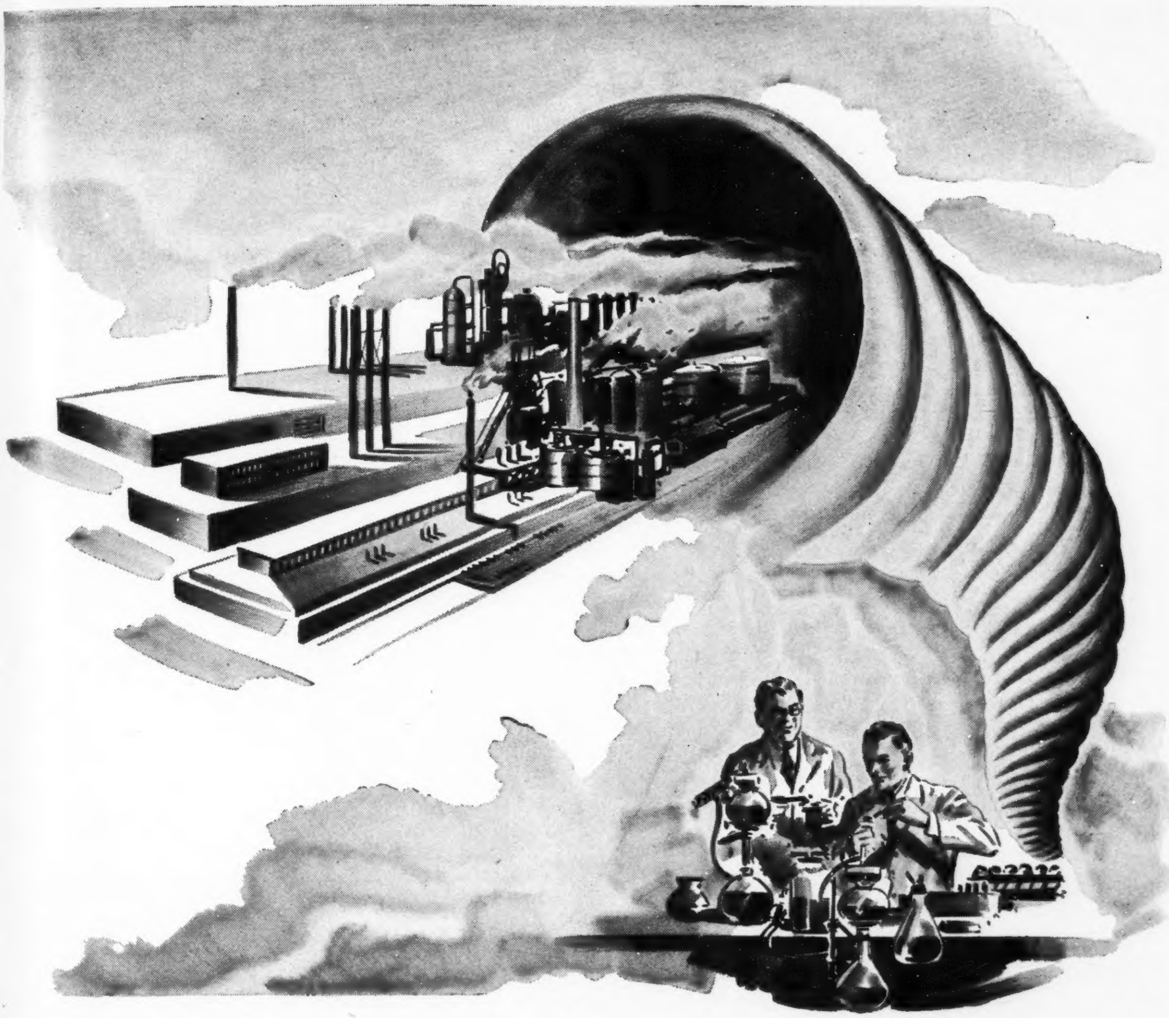
In the method of heat balances it is necessary to calculate the radiant heat exchanges between the several room surfaces. This involves a knowledge of all surface-to-surface angle factors; for example, what fraction of the radiant energy emitted by the ceiling is in such direction as to be intercepted by the floor, an exterior wall, an interior wall, or a window surface? The necessary angle factors were calculated and presented during 1943 in Bulletin No. 32 of the Cornell University Engineering Experiment Station by Mackey, Wright, Clark, and Gay.

Model Room

A model room was then constructed to a one-third scale. Dr. Wright and Mr. N. R. Gay, assisted by mechanics from the Mechanical Laboratory Department, built the room. Mr. Sherwood Holt, '43, representing the Atmos Society which became interested in the project, contributed valuable services in this part of the program. The inside dimensions of the model room are 4 feet by 5 feet by 2 feet 8 inches. To minimize edge effects, the two exterior walls of the room are made of ¼ inch plywood of known thermal conductance; to simulate the effect of interior partitions, the other two walls of the room, as well as the floor panel, are heavily insulated with glass wool. The heating panel is made in nine sections with nichrome wire, which is heated electrically. Any combination of these sections may be heated; at present the room is set up with the ceiling as the heated panel. Under the supervision of Dr. David Dropkin about seventy-five thermocouples were installed in the model room to measure surface and air temperature. The room is constructed in sections, and it is possible to change the material and thickness of the exterior walls, if desired. The electrical energy used by the heating wires is metered, and a small blower, mounted outside of the room, supplies air at a metered rate to the inside of the room, so that the rate of air change may be adjusted. There are three globe thermometers in the model room to measure mean radiant temperature; one globe thermometer is in a fixed position, while the others may be moved from the outside to sample the mean radiant temperature at different points within the room.

If absorption of radiant energy by the water vapor and carbon dioxide of the air is not important, a model room having the same proportions as the prototype room has the same radiant heat exchanges. To illustrate, the fraction of the radiant energy emitted from a 4 foot by 5 foot floor which is in such direction as to be intercepted by a 5 foot by 2 foot 8 inch wall is exactly the same as from a 12 foot by 15 foot floor to a 15 foot by 8 foot wall. To insure the same film coefficients of convective heat transfer in the model room as in the prototype, no dimension of the model room shuld be less than 2 feet. If the ratio of air change in the model room is made n times as great as

(Continued on page 24)



Panel Heating

(Continued from page 22)

that expected in the prototype, where n is the scale ratio, the method of heat balances indicates that the various surface temperatures and the required rate of heat supply per square foot of panel or wall area in the model room will be the same as in the prototype.

The model room is now in place in the constant temperature room, and some preliminary tests have been run by Dr. Dropkin and Mr. G. A. Nothmann. The temperature of the air in the constant temperature room may be held constant at any desired value to reproduce the temperature of outdoor air. Electrical energy is then supplied to the heated ceiling panel until an equilibrium condition is established with the operative temperature maintained at 70°F at a selected point. The required rate of heat supply and the uniformity of the physical environment may then be determined. Variables which may be changed in different tests include the temperature of the outdoor air, the rate of air change, the construction (thermal resistance) of the exterior walls, and the location of the heated panel. A few tests will check or disprove the validity of the assumptions made in using the method of heat balances. If the method of heat balances accurately predicts the results, then engineering calculations may be based upon this method to study more involved methods of panel warming such as the heating of selected strips rather than entire panels.

Future Tests

In later tests reflecting foil may be applied to the room surfaces to investigate the use of materials having a high reflectivity for incident radiant energy upon economy of heating and uniformity of physical environment. In this connection it may be noted that in a completely reflecting enclosure, the human body can lose no heat by radiation. With this situation and in "still" air the air temperature must be about 55° to give an operative temperature of 70°F. The average temperature of the outdoor air during the heating season in this climate is about 40°F; reduction of the average required daily temperature of the indoor air to 55°F from 70°F would cut the seasonal fuel consumption in two. Of course, this represents a limiting case which can not be realized because some of the room surfaces, and particularly, the room furnishings, can not be made wholly reflecting. There is, however, an attractive margin to be explored.

It is hoped that the use of a model room in the study of the physical environment will yield much valuable data at relatively small cost. Later, in the full-scale room, the physiological and psychological environments may be studied by using human subjects. Also, various methods of heating the panel may be investigated, including the use of hot air, steam, hot water, and electricity. The reversed refrigeration cycle may be considered as a means of heating.

Guarding One Billion

(Continued from page 7)

cality.

All employees are instructed in the procedure to be taken in the case of finding an actual or suspected bomb, or what to do in the case of suspicious actions, warnings or threats received verbally by phone or otherwise. In general, any information received relating to a threatened act of sabotage on or adjacent to electric stations, the Operator shall immediately notify the System Operator giving any detailed information as to date, time and place of the threatened act. When definite information is received that an article suspected to be a bomb or other harmful device has been found on or adjacent to station property, the Operator shall first call the Police Department Bomb Squad for assistance, then the Watch engineer and Electric Watch Foreman (in generating stations), and after that, the System Operator. The station supervisors shall see that the following things are done acting concurrently when possible. Inflammables should be removed from the area, fire-fighting equipment should be made ready, and all gas cut-off valves feeding into the danger zones shall be closed. All persons not actively engaged in carrying out these procedures shall be cleared from the area, and as much operating equipment in the immediate vicinity shall be shut down as is prudent. Furthermore, if the location of the suspected bomb makes it possible, blasting matting and sandbags are to be placed around the bomb, great care to be taken not to disturb it. A 60 gallon empty container and an adequate amount of light oil in separate tins shall be brought to the location and the container filled at the site. No attempt shall be made on the part of employees to move a suspected bomb.

General Protection

The general protection of stations and areas of major importance is accomplished by means of fencing, floodlighting, watchmen, guards and several types of automatic and manually actuated alarm systems. In some cases the guards are mounted where large areas are involved. In other locations high watch towers having a commanding view of the surroundings are used. All guards and watchmen have been sworn in as Auxiliary Military Police and have Army supervision and discipline in addition to their company administration.

The instruction and inspection of the guards was undertaken by former police officials and is very thorough on matters of knowledge and enforcement of all rules and orders, the preparation and forwarding of records, the protection of life and property, the reporting of violations and the prevention and detection of attempted sabotage, and particularly in observing unusual occurrences of even minor nature. Perception of such incidents has resulted in many cases where Consolidated Edison guards have assisted City Police and Federal authorities in apprehending subversive persons, one example being the arrest of a Japanese who couldn't explain why he was loitering near a mid-town gas plant which in turn led to the discovery of nearly three score unregistered enemy aliens.

All accidents to equipment, un-

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Guarding One Billion

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usual operations, failures to function correctly, and fires are investigated in the first instance on the assumption of sabotage. When the evidence is not definitely established as absolving the suspicion of sabotage, investigators are brought in to make a complete analysis of the evidence. The most natural appearing damage or interruption is the ideal from the saboteur's point of view; what appears to be a usual type of failure, especially if serious, requires painstaking study of the material evidence, the persons involved, and the circumstances of the failure, in order that proper conclusions may be reached. So far there has been no conclusive evidence of sabotage in any case of failure of equipment or accident to any person.

Contrary to some belief, no general shutting off of electric power or gas supply is contemplated by utilities during aerial attack. However, during an actual attack no rehabilitation work would be undertaken, but activities to prevent the spread of damage and protection of property would be carried out. Plants are expected to operate during raids under conditions of "blackout". All employees on fixed post whose duties are necessary for continuity of service must remain at their stations. Other employees, for the most part maintenance men, will go to safe areas on notification that planes are in the immediate vicinity of the station.

Automatic Devices

The primary protection of a huge metropolitan transmission and distribution system against sabotage is essentially identical with the inherent protection against electrical failure; that is by automatic devices which instantly disconnect the faulted line from the system. This gives immediate indication in the stations of the feeder in trouble, and fault location crews start at once to identify the point of failure or trouble. To make access to important manholes very difficult, their covers are sealed with compound, thus making their removal a slow and noticeable job, which acts as a deterrent to unauthorized persons. The loss of a manhole and feeders therein is at worst a nuisance of relatively short duration.

In planning for the prevention of the spread of damage during a raid and for the rapid restoration of service to localities, or for the immediate patching up of minor damage to stations, there is a comprehensive mobilization plan for "out of office hours" which contemplates assembling key men at diversified locations with the necessary transportation and equipment to be held in readiness for movement to a damaged area. This plan also contemplates assembling such additional help as may be deemed necessary, but no persons other than those designated assemble "out of hours" without being called on at the time. Otherwise they report at their normal time and location for assignment.

In connection with local civilian defense organizations, incidents are frequently practiced, and all air raid and blackout procedures are practiced during community drills.

The general concensus of opinion is that the utilities have not only more than met their obligations to furnish the motive power for war production, but have amply provided for the security of their plants and distribution facilities.

George Beck

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cerned with the building and servicing of physical and psychological laboratory equipment for commercial firms and for the University,—"everything from electroencephalographs to voltage regulators." He officially joined the staff in July, 1943.

Mr. Beck really gets enthusiastic about his course. He told us how each senior in Communications is given a project, limited by definite specifications, such as the design and construction of a vacuum-tube voltmeter or an ultra-high frequency oscillator. He then completes the design, construction, and tests and applies whatever corrections are necessary. Beck explained that the course attempts to utilize the student's background while necessarily curbing over-ambitious enthusiasm.

"The course attempts to further the idea of good industrial practice," Mr. Beck said. "Not maximum performance and hang the cost, but optimum performance is the object."

Due to numerous "service calls," Mr. Beck has become known outside the E.E. department. It seems that when things go wrong with communications or electronic apparatus in other schools, the communications school staff members are often called in and dared to locate the trouble. George's success in shooting trouble is eloquent testimony to the value of his experience in repair work.

When asked about his plans for the future, he stated that he hoped to continue teaching and working for his degree. He is still interested in developing electronic equipment for laboratory use and feels that there is a great future in this work. He plans to take up his hobby of high fidelity radio and phonograph equipment after the war.

A few years ago Mr. Beck made a trip west to spend a few weeks' vacation. He was so fascinated with the country that he stayed for four months, and he plans to retire there some day. "I'll probably be about seventy-five when I get around to it," he explains, "but some day I'm going to settle out in the Rockies and take one long rest!"

Albert Beehler

(Continued from page 15)

apprentice seaman, Al proudly managed this year's highly successful soccer team. Nicky Bawlf, who coaches the hockey as well as the soccer team, has asked him also to manage the ice squad this winter. Al also has been a busy member of the program committee for Senior Week at the end of February.

At the end of the present term, Al and his classmates will depart for Midshipman's school. After that he is looking forward to going wherever the Navy sends him. He leaves with confidence in his ability to get along with his fellow worker and with the assurance that his engineering background will help him overcome any technical barriers in his path.

Robert Rochlin

(Continued from page 15)

corresponding secretary of Tau Beta Pi.

Summer vacations have found Bob working in varied capacities. His frosh summer was spent in the employ of United States Electric Motors Inc. near Milford, Connecticut, as an unskilled laborer on an assembly line. Although this work did not involve any engineering ability, Bob feels he gained valuable experience, the type he thinks every engineer should have before holding any sort of executive position. The following summer found him in McKeesport, Pennsylvania making control wiring diagrams for large electric motor installations for the National Tube Company. The vacation at the end of his junior year was a brief one of five weeks during which he worked for the Western Electric Co. designing testing equipment for vacuum tubes. His immediate future is dependent on the whims of the draft board, but after the war he hopes to go into research work in some industrial laboratory.

Despite Bob's decided flare for the technical, he is of the opinion that engineers have a tendency to become solely technicians substituting in the formulas and grinding out results. He has found that too many of them become so absorbed in their work that they become narrow-minded and well versed only in their particular field, and are as a result failures in other respects. Since the welfare of the country depends on its citizens, engineers should take an intelligent share in the running of the country by taking an interest in their obligations as members of the community. At the same time he feels that they should take an interest in a great many other things so that they can become interesting people as well as adept in the manipulation of a slide rule.

Reviewing Stand

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definitely limit the book's usefulness in bridge engineering. In addition, the author's discussion is confined to frames with straight members. An extension of the slope deflection method to include frames consisting, in part, of arched members, such as they arise, for instance, in hangar design, would have been desirable.

George Winter
Assistant Professor of Civil Engineering

Naval Training

(Continued from page 13)

tered as student officers with the rank of ensign or above, have gone to sea on all types of combat craft, including battleships, cruisers, destroyers, carriers, escort ships, mine layers, submarines, and PT boats.

Starting March 1, the Naval Training School will build up toward its largest enrollment when a U.S. Naval Reserve Midshipmen's School is established here for the training of deck officers and of officers in steam engineering.

At that time an initial class of 200 apprentice seamen from college V-12 training programs will arrive at Cornell to begin the four months' course. Of the total, 175 will be in deck officer training and 25 in steam engineering.

On the first of each succeeding month, similar groups of 200 Navy men will be assigned to Cornell until an over-all strength of 800 is reached in June. It will be maintained at that figure; and as 200 graduate each month after completing the 4-month course, 200 others will arrive as replacements.

The first month here will be a period of indoctrination. Then the men will be appointed as midshipmen for the next three months, and on completion of the training course, they will be commissioned ensigns.

Announcement of the new program means that the deck officer training and steam engineering activities, which have been centered at Cornell for more than a year, will be carried on under the Midshipman's School rather than the General Service School.

AIEE

The Cornell student branch of the A.I.E.E. held a meeting on January 20. Professor W. C. Ballard, Jr. gave a talk on fluorescent lighting tubes and circuits. He gave demonstrations of different kinds of tubes and starters.

A short business meeting followed the lecture. The following officers were elected:

Chairman, Robert P. Burr, V-12
Vice-Chairman, R. Patrick, V-12
Secretary, N. J. Markason, EE, '44
Treasurer, Joseph E. Bambara, V-12

The next meeting of the Cornell student branch will be on February 24, when Joseph Short, program director at WHCU, will talk on what goes on behind the scenes at a radio station.

Membership cards are being made out, and will be distributed to all new members.

Atmos

Atmos, honorary mechanical engineering society, in a recent meeting, elected the following new members:

E. L. Wheless, ROTC, '44
R. H. Allen, ROTC, '44
F. D. McNair, V-12
F. Ludden, ROTC, '44
J. Clasgens, V-12
A. M. Beebee, V-12
Wm. Parker, ME, '44
F. Swingle, V-12
M. Britton, V-12
C. D. Correll, Jr., V-12
H. W. Bacon, ME, '44
George Spransy
P. Strelinger
Wm. D. Wood, ME, '44
C. Hayssen, V-12
F. Herring, ME, '44

New officers have not yet been elected, but a meeting will be held soon to do this.

STRESS and STRAIN...

Scratching: "How do you get rid of these awful cooties?"
"That's easy. Take a bath in sand and rub down in alcohol. The cooties get drunk and kill each other throwing rocks."

* * *

Soph: "You want to keep your eyes open around here."
Frosh: "What for?"
Soph: "People will think you're a fool if you go around with them shut."

* * *

"Lady, if you will give us a nickel my little brother'll imitate a hen."
"What will he do?" asked the lady, "cackle like a hen?"
"Naw," replied the boy in disgust. "He wouldn't do a cheap imitation like that, he'll eat a woim."

* * *

He: "You know that coed I was out with last night?"
He II: "Yeah."
He: "I found out she had a glass eye."
He II: "Howja find out?"
He: "When I put my arms around her and squeezed, it lit up and said 'tilt'."

* * *

Agent: "Sir, I have something here which will make you popular, make your life happier and bring you a host of friends."
Student: "I'll take a quart."

* * *

"Hello there, my young fellow."
"Hiss."
"Beg pardon?"
"Hiss."
"You're an impertinent little devil."
"Hiss."
"Deserve a good licking—and here I come to give it you you."
Headline: Drunk crushed by boa constrictor at zoo.

* * *

"She's like a beautiful photograph in that bathing suit of hers."
"Yeah — underdeveloped and overexposed."

"I wonder who this telegram is from."
"Western Union, I recognize the handwriting."

* * *

Patriotic citizen during the war addressing a youth milking a cow: "See here, young man, why aren't you at the front?"
"Wal, I reckon it's mostly because this cow ain't no different from any other cow."

* * *

"See that girl? That's my girl."
Uh-huh—good looking fur coat she's wearing."
"Yeah, I gave her that."
"Pretty hat, too."
"Yep, I gave her that."
"Boy, what a sparkler she's wearing."
"Sure it is, I gave it to her."
"And say, that's a cute little boy she has with her."
"Yeah, that's her little brother."

* * *

Coed: "Do you rhumba?"
V-12: "No, that was my stomach."

* * *

He: "Where can I get a hold of Mary?"
2nd He: "Well, I don't know. She's awfully ticklish."

* * *

Mrs. (sternly to husband arriving at 3): "What does the clock say?"
Mr. (genially): "It shay 'tick-tock,' and the li'l doggies shay 'bow-wow,' an' the li'l pushy-cat shay 'meow-meow'."

* * *

"Mother," said Johnny, "is it correct to 'water the horse' when he's thirsty?"
"Yes, quite correct."
He (picking up the saucer): "I'm going to milk the cat."

* * *

"Do you love me dear?"
"Dearly sweetheart."
"Would you die for me?"
"No, my pet. Mine is an undying love."

Exercise kills germs, but we haven't found out how to get the darn things to exercise.

* * *

"Now," said the college man to his dad at the football game, "you'll have more excitement for two dollars than you ever had before."
"I don't know," replied the old gent. "That's what my marriage license cost me."

* * *

A dainty foot, a lovely torso
Can make a friendly feeling
more so.

* * *

Proverb: A ring on the finger is worth two on the phone.

* * *

John had been invited to the funeral of a neighbor's third wife, and, as he had attended the funerals of the first two, his own wife was surprised when he informed her he was not going.
"But why aren't you going to this one?" asked his wife.
"Well, Mary, it's like this. I feel a bit awkward to be always accepting Bill's invitations when I never have anything of the sort to ask him back to."

* * *

Two small negro boys were sitting on a curb. One turned to the other and said, "Ah's five, how old is yo?"
"Ah doan know. Ah guess ah's five too."
"Does you dream of wimmen?"
"Nope."
"Yo's only foh."

* * *

His wife was a WAVE
And he waved at a WAC
The WAC was in front
But his WAVE was in back
Instead of a wave from the WAC
Be it said
He got a whack from the WAVE
He had wed.

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